lowering of the Parliamentary standard of sixteen to fourteen candle power in the case of the South Metropolitan, Commercial and West Ham Companies will soon be followed by many companies now saddled with a higher standard than fourteen candles seeking relief. That relief cannot in fairness be refused, whilst experience of the benefits conferred by the reduction will soon lead to the further step that will place gas manufacture in this country on the same advanced footing that it has already gained in the most progressive cities in Germany.

In making low-grade gas of this character, several processes may be employed, but probably the most economical is to utilise water gas as an aid to the distillation of the coal in the retorts, the proportion of water gas so used being kept down to a point at which the carbon monoxide in the finished gas shall not exceed 16 per cent.

The cheapening in mantles which is now taking place, together with improvements in their manufacture which will give an increased length of life and light, promises a great extension in the use of gas for this purpose.

Another direction in which the future of coal gas will benefit largely, by a cheapening in price owing to economies in manufacture and distribution, will be for use as a fuel. Already the ever-increasing demand made upon the metropolitan companies during the day marks the advance of the utilisation of coal gas for cooking, heating and power, so that whilst the increase in the amount of gas used at night is only rising by some 3 per cent. annually, the day consumption shows an increase of 16 per cent. Directly it becomes possible to reduce the price of gas to about 2*s*. a thousand, advance on these lines will become extremely rapid, and the gas companies are naturally doing everything in their power to foster this development. It is, however, necessary, in order further to popularise gas as a fuel, that everything that can be done should be done to remove any prejudices that exist against heating by gas.

There are many excellent gas stoves on the market, well designed, and giving high heating duty for the gas consumed, but there are also many that, both in their performance and their effect upon the atmosphere, are radically bad. Now that the gas companies have so largely taken over the sale and pushing of gas-heating apparatus, it is a duty they owe to themselves and to their customers to take care that only stoves of scientific construction and good efficiency should be supplied. Many of the worst stoves are the most ornate, and for that reason find their way into many homes, as they, in the first place, appeal to the eye of the housewife, and afterwards to the nose and health of the household, the result being that a good customer is converted into an enemy of gaseous fuel. No gas fires should be sold or let on hire that do not do a large proportion of the heating by radiation, and a gas company that sells a flueless gas stove, save for hall or passage heating, should be prosecuted.

A cubic foot of coal gas on its complete combustion yields 0.52 cubic foot of carbon dioxide and 1.30 cubic feet of water vapour, and if you do not mind breathing hot polluted air highly charged with water vapour, and getting chilled with cold walls, a Bunsen burner stood on the floor is the most effective method of getting the whole of the heat of combustion into the air of the room, and no flueless stove can do more than this. In order to get something to sell, stoves are constructed in which some of the water is condensed, and the public are gravely informed that this removes all deleterious products. But it is impossible to get away from the fact that if healthful heating is to be obtained, it is the solid objects and walls of the room that must be heated, and not the air, and that although some of the heat is lost thereby, a flue to take off all products is an absolute essential.

The gas companies have it in their power to govern the gas-stove trade, and unless they choose to take the initiative, it will retard the popularity of heating by gas to a most serious degree. With all stoves in which solid bodies like asbestos are heated by atmospheric burners, a trace of carbon monoxide is always produced, and if there is not a proper flue passing well into the chimney, a headache is added to the other discomforts.

Improvements in gas motors and gas engines are steadily going on, and as soon as the price of coal gas can be reduced sufficiently to attract this class of custom, a wide field will be opened up for it.

The development of large gas engines during the last few years gives promise of an entire revolution in our methods of procuring power, and it is highly probable that within a very few years the gas engine will make great inroads upon the generation of power by steam. Already gas engines up to 1500 horse-power have been constructed, whilst engines of more than double that power are under construction.

In England, Messrs. Crossley Brothers and other well-known makers are producing a very large number of such engines for driving dynamos, whilst it is stated that on the Continent Messrs. Korting Brothers have made, or have under construction, thirty-two gas engines, with a total of 44,500 horse-power, averaging 1390 horse-power each engine, and the John Cockerill Company and several German companies follow not far behind.

With such a development of gas for motor purposes, it is manifestly the policy of the gas companies to make a determined bid for so wide a field of output, and if they can supply a clean heating gas with 460 to 500 B.T.U.'s heating power, it is clear that the convenience of doing away with separate generating plant would cause a large proportion of this business to fall to their share, if the price of the coal gas could be made to compete with a fuel gas, that is to say, if nearly the same number of thermal units could be obtained by its use at the same cost.

Gas fittings should be entirely taken over by the gas companies, which should supply incandescent fittings and mantles and keep them in order at a small yearly rental; and where swinging brackets and other causes demand flat-flame burners, the companies should fit nipples with broad slits regulated to burn at the lowest possible pressure.

Everything at the present time points to the gas of the future being a twelve-candle-power gas, with a calorific value of not less than 460 B.T.U.'s net and a selling price of not more than 2*s*. a thousand, the economies necessary to reach this lower price being brought about by making the gas in the holder at 9*d*. to 9½*d*. a thousand and distributing it at a considerably increased pressure, the pressure being regulated down to 1½ inches at the entrance to the consumer's meter.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. C. B. N. Cama, St. John's College, has been elected to the Isaac Newton studentship in optics and physical astronomy.

The Smith's prizemen are Mr. H. Knapman, Emmanuel, second wrangler 1901, and Mr. A. P. Thompson, Pembroke, fifth wrangler 1901. Mr. W. H. Jackson, Clare, bracketed third wrangler 1901, receives honourable mention.

The following have been appointed as representatives of the University to the joint committee of the Royal Society for the purpose of securing an appropriate memorial of the late Sir G. G. Stokes:—The Chancellor, the Vice-Chancellor, Profs. Jebb, Forsyth, Darwin, Ball, Thomson and Mr. W. Burnside.

THE Sedgwick Memorial Museum syndicate, in an amended report, estimates that the cost to the University of the new building, over and above the amount contributed from the memorial fund, will be not less than 18,480*l*.

IT is stated that Mr. David Davies, of Llandinam, grandson of the late millionaire, has presented the University College of Wales, Aberystwyth, with a sum of 20,000*l*.

THE New York correspondent of the *Daily Mail* announces, on the authority of the *New York Journal*, that Mr. Carnegie has arranged to present 200,000*l*. to Princeton University as a thank-offering for his recovery from his recent illness.

LORD AVEBURY will take the chair on March 17 at a conference on higher education at the Institution of Mechanical Engineers, Storey's Gate, Westminster. Representatives of the county and county borough councils and

other educational bodies have been invited to attend the conference by the National Association for the Promotion of Technical and Secondary Education.

IN connection with the seventeenth annual Exhibition of Arts, Crafts and Industries, which will be opened on May 4 in the Town Hall, Hammersmith, by the Duchess of Argyll, a special "nature-study" section has been organised by Mr. W. M. Webb. Prizes and certificates are offered to pupils in schools in Hammersmith for exhibits illustrating, among other subjects, rambles or visits to a park, nature-study diaries, pea plants grown in pots with descriptions of their growth, drawings of living plants or animals, the life-history of any animal (in the wide sense of the word) from personal observation, and nature-study photographs.

THE committee of the Bombay University, appointed to consider the recommendations of the recent Universities Commission, has, we learn from the *Pioneer Mail*, come to the conclusion that both the Senate and the Syndicate work satisfactorily and need not be changed; second-grade colleges should not be disaffiliated; a limit of age and minimum fees should not be fixed, and the study of law should not be concentrated in a central college. Moreover, the Senate objects to interference from outside with the courses of study, and considers that the University should be allowed to control such matters in its own way.

THE Johnston Laboratory at University College, Liverpool, built and equipped by Mr. William Johnston, of Bromborough, will be opened by the President of the Local Government Board on May 9. The laboratory will contain the following departments:—Bio-chemistry, under the direction of Prof. Benjamin Moore; tropical medicine, directed by Prof. Ronald Ross, F.R.S.; experimental medicine and comparative pathology, directed by Dr. A. S. Grünbaum, who will also have charge of the cancer research, for which, as we have already announced, Mr. T. Sutton Timmis recently provided a gift of 10,000*l*. Mr. Johnston has also endowed the professorship of bio-chemistry and three fellowships in various branches of medical research.

SIR OWEN ROBERTS distributed the prizes and certificates to the students of the South-Western Polytechnic on February 23. The report of the principal, Mr. Herbert Tomlinson, F.R.S., was read, and showed the number of adult students in the institute to be rapidly increasing, so much so, indeed, that the volume of work as estimated by the student hours has in the last four years been doubled. During last session upwards of 600 students entered the day colleges for men and women, and nearly 1800 the evening classes. Two years ago large additions, costing 12,000*l*., were made to the buildings, but these proving insufficient, a still further sum of 13,000*l*., provided, like the former sum, by the Trustees of the London Parochial Charities and the London County Council, is now being expended in providing a large hall and further workshop and laboratory accommodation. The long list of successes of students shows that the number of certificates gained during last session was above 150 more than in the previous year, but, as was pointed out by the principal, the proper function of the institute is not merely to prepare students for examinations, but to fit them to earn a living, and the institute owes a good deal of its popularity to the recognition of this by the management.

THE address on science workshops for schools and colleges delivered by Prof. H. E. Armstrong, F.R.S., to the Royal Institute of British Architects last month is printed in full in the *Journal* of the Institute (vol. x. No. 6). Prof. Armstrong illustrated his arguments by reference to the new buildings at Horsham for Christ's Hospital School, of which he is a governor. The science buildings occupy practically one side of the quadrangle, and the floor area of the rooms they contain is 10,326 square feet, while that of the ordinary class rooms of the school only reaches 15,482 square feet. The four chief rooms in the science block are called science "workshops," and are distinguished by the names of Cavendish, Dalton, Davy and Faraday, and to each of these are attached certain subsidiary rooms. No lecture room is provided, since it is desired to discourage didactic teaching—a demonstration bench in the workshop amply provides for any such teaching as is necessary. No special balance room has been introduced, but instead a balance bench—a long narrow table covered by a glazed case for the protection of balances, and arranged at right angles to the working benches. A store or stock room is attached to each of the workshops. There are two kinds of working benches, those for ordinary work and those at which work involving the use of water may be done. The former have teak tops, and the latter are covered with lead. In the rooms on the upper floor, all sinks have been placed near to the walls, and the waste is carried down to the floor below in pipes fixed in chases in the walls. On the basement floor, cross channels have been avoided as much as possible. In three rooms an arrangement has been adopted which provides both a gas service and upright supports to which rings, &c., can be clamped. The space below the bench-top is fitted with two tiers of small cupboards; inside each cupboard is a small drawer. Each bench has four such cupboards, so that four pupils may occupy the place in succession, and each have a cupboard. Prof. Armstrong also gives invaluable hints as to the construction of sinks, drains and ventilation hoods, and describes some special appliances which are in use at Christ's Hospital School. The address concludes with a plea for the simplification of school workshops, and the recommendations are well summed up in Prof. Armstrong's own words, "in designing science workshops the architect . . . should have three S's in mind—*Sense, Simplicity* and *Space*."

SCIENTIFIC SERIAL.

American Journal of Science, February.—Good seeing, by S. P. Langley. A study of the conditions necessary to the formation of a tranquil image in a telescope (see p. 400).—Native arsenic from Montreal, by N. N. Evans. The native arsenic was found in a vein of nepheline syenite at the Corporation Quarry, near Montreal. On analysis it proved to contain 98·14 per cent. of arsenic, 1·65 per cent. of antimony, with traces of sulphur.—Electromotive force in plants, by A. B. Plowman. The experiments described show that the functional activities of a plant give rise to differences of electrical potential in its parts, the intensity and relative sign of these differences depending upon the physiological condition of the plant, as well as upon its electrical conductivity.—The ionisation of water nuclei, by C. Barus.—The morphogenesis of Platystrophia. A study of the evolution of a Palæozoic Brachiopod, by E. R. Cumings.—Note on the condition of platinum in the nickel-copper ores from Sudbury, by C. W. Dickson. An account of the isolation of sperrylite, platinum arsenide, from chalcopyrite.—Lecture experiment on surface tension and surface viscosity, by J. E. Burbank.—Mylagaulodon, a new rodent from Oregon, by W. J. Sinclair.—Studies in the Cyperaceæ, by T. Holm. On *Carex fusca* and *Carex bipartita*.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, February 27.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—A paper by Prof. **Fleming** and Mr. **Clinton**, on the measurement of small capacities and inductances, was read by Prof. Fleming. The measurement of small capacities and inductances has become important in connection with Hertzian wave wireless telegraphy. The authors have designed a rotating commutator which renders the measurement of small capacities a matter as easy as the measurement of resistance on a Wheatstone bridge. The appliance is described in the paper, and the authors claim that they have worked out a thoroughly satisfactory form of rotating commutator, designed more from the point of view of an engineer than an electrical instrument maker. For use with the instrument a moving-coil differential galvanometer has been designed. The authors have made a number of experiments upon the capacity of aërial wires, such as are used in Hertzian wave telegraphy, and have also investigated the laws governing the capacity of such wires when grouped together in certain ways and verified experimentally, as far as possible, the formulæ for the capacity of insulated wires in various positions in regard to the earth. The experiments are given at length in